

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT(S) : Thangaraj et al. :  
 : Prior Examiner: N. Nguyen  
 SERIAL NO. : Not yet assigned :  
 : Art Unit: 1754  
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 FOR : METHOD AND DEVICE FOR THE PRODUCTION OF AN  
 AQUEOUS SOLUTION CONTAINING CHLORINE DIOXIDE

Box Patent Application  
 Assistant Commissioner for Patents  
 Washington, D.C. 20231

PRELIMINARY AMENDMENT

This is a preliminary amendment of a divisional application filed under 37 CFR 1.53(b), of prior pending application Serial No. 09/306,035 filed on May 6, 1999, of Thangaraj et al., for METHOD AND DEVICE FOR THE PRODUCTION OF AN AQUEOUS SOLUTION CONTAINING CHLORINE DIOXIDE. It is respectfully requested that this amendment be entered before calculating the filing fee for this divisional application. A clean copy of the claims in the divisional application after entry of this amendment is enclosed.

Please amend the specification as follows:

Page 15, lines 19-21, delete "Such materials . . . incorporated by reference herein".

Please amend the claims as follows:

Please cancel claims 1-10, 14-25 and 30-40.

26. (Amended) A device [which generates] for producing an aqueous solution of chlorine dioxide [in the presence of water but not in the substantial absence of water, the device] comprising a water-permeable membrane defining at least in part, [an enclosed space] a first zone and a second zone, said first zone containing liquid water and said second zone containing a mixture of at least one metal chlorite and at least one acid forming component, said acid forming component being selected from the group consisting of water soluble acids, water soluble acid salts, synthetic molecular sieves, acid ion exchange resins, acid treated clays and acid treated calcined clays, and wherein said at least metal chlorite and said at least one acid forming component in said mixture

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react with each other in the presence of water but not in the substantial absence of water to produce chlorine dioxide, said membrane being made of a material which permits: (a) liquid water and/or water vapor to pass therethrough into the [enclosed space] second zone to allow the mixture of at least one metal chlorite and at least one acid forming component to react to product chlorine dioxide and (b) the so produced chlorine dioxide to pass therethrough out into the liquid water in the first zone to produce the [product] aqueous solution [containing] of chlorine dioxide.

Please add the following new claims:

41. The device of claim 26 wherein the metal chlorite is selected from the group consisting of alkali metal chlorites and alkaline earth metal chlorites.
42. The device of claim 26 wherein the metal chlorite is sodium chlorite.
43. The device of claim 42 wherein the acid forming component is a dry water soluble solid which produces an acidic solution when dissolved in water.
44. The device of claim 43 wherein the acid forming component is selected from the group consisting of acids and acidic salts.
45. The device of claim 44 wherein the acid is selected from organic acids.
46. The device of claim 45 wherein the organic acids are selected from the group consisting of citric acid, tartaric acid, and oxalic acid.
47. The device of claim 46 wherein the organic acid is citric acid.
48. The device of claim 44 wherein the acidic salts are selected from the group consisting of alkali metal acid salts and alkaline earth metal acidic salts.

49. The device of claim 44 wherein the acidic salts are selected from the group consisting of magnesium nitrate, lithium chloride, magnesium sulfate, aluminum sulfate, sodium acid sulfate and potassium acid sulfate.

50. The device of claim 26 wherein the synthetic molecular sieves are selected from the group consisting of synthetic zeolite Y, dealuminated Y, mordenite and ZSM-5.

51. The device of claim 26 wherein the acid forming component produces a pH of below about 5 when mixed with water.

52. The device of claim 26 wherein the aqueous solution of chlorine dioxide has a pH of between from about 2 to about 10.

53. The device of claim 26 wherein the membrane is water softenable.

54. The device of claim 26 wherein the membrane is at least partially water soluble.

55. The device of claim 54 wherein the membrane dissolves in water after a period of time at least equal in length to the time it takes the metal chlorite and the acid forming component to substantially react to produce chlorine dioxide.

56. The device of claim 26 wherein the membrane is made of a material selected from the group consisting of gelatin, polyvinyl alcohol, cellulose and derivatives thereof.

57. The device of claim 56 wherein the derivative of cellulose is hydroxypropyl methyl cellulose.

58. The device of claim 28 wherein the membrane material is made from a microporous nonwoven hydrophobic polymer.

59. The device of claim 58 wherein the microporous nonwoven hydrophobic polymer is selected from polyethylene and polytetrafluoroethylene.

60. The device of claim 26 wherein the membrane contains openings of sufficient size to enable the controlled passage of water into contact with the metal chlorite and the acid forming component.

61. The device of claim 26 wherein the mixture is present in the second zone in the form of tablets.

62. The device of claim 26 wherein the mixture is present in the second zone in the form of powders.

63. The device of claim 26 wherein the mixture is present in the second zone in the form of granules.

64. The device of claim 26 wherein the mixture is present in the second zone in the form of pellets.

65. The device of claim 26 wherein the mixture is present in the second zone in the form of agglomerates.

66. The device of claim 65 wherein the agglomerates in the second zone are present as two types:

- (a) a first type comprising at least one metal chlorite or a mixture of one or more metal chlorites and one or more non-acid forming additives; and
- (b) a second type comprising at least one acid forming component or a mixture of one or more acid forming components and one or more metal chlorite-free additives.

67. The device of claim 66 wherein the non-acid forming additives are selected from the group consisting of silica gel desiccant, paraffin wax tableting binder, sodium sulfate filler and mixtures thereof.

68. The device of claim 66 wherein the metal chlorite-free additives are selected from the group consisting of ion exchangers, tableting binders, desiccants and mixtures thereof.

69. The device of claim 65 wherein the agglomerates have a particle size of at least 80 microns.

70. The device of claim 69 wherein the agglomerates have a particle size above about 500 microns.

71. The device of claim 70 wherein the agglomerates have a particle size above about 1,000 microns.

#### REMARKS

This divisional application is directed to a device for producing an aqueous solution of chlorine dioxide, whereas the parent application was directed to a method for producing such solution. The sole independent claim 26 has been amended so as to incorporate the limitations of claim 1 as allowed in the parent application and should therefore be held allowable for the same reasons as set forth in the examiner's statement of reasons for allowance in the parent application. Accordingly, it is respectfully requested that this divisional application be examined and passed to issue forthwith.

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Respectfully submitted,



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**CLEAN COPY OF CLAIMS**

26. A device for producing an aqueous solution of chlorine dioxide comprising a water-permeable membrane defining at least in part, a first zone and a second zone, said first zone containing liquid water and said second zone containing a mixture of at least one metal chlorite and at least one acid forming component, said acid forming component being selected from the group consisting of water soluble acids, water soluble acid salts, synthetic molecular sieves, acid ion exchange resins, acid treated clays and acid treated calcined clays, and wherein said at least metal chlorite and said at least one acid forming component in said mixture react with each other in the presence of water but not in the substantial absence of water to produce chlorine dioxide, said membrane being made of a material which permits: (a) liquid water and/or water vapor to pass therethrough into the enclosed space second zone to allow the mixture of at least one metal chlorite and at least one acid forming component to react to product chlorine dioxide and (b) the so produced chlorine dioxide to pass therethrough out into the liquid water in the first zone to produce the aqueous solution of chlorine dioxide.

27. The device of claim 26 wherein the membrane is substantially water soluble.

28. The device of claim 26 wherein the membrane is substantially water insoluble.

41. The device of claim 26 wherein the metal chlorite is selected from the group consisting of alkali metal chlorites and alkaline earth metal chlorites.

42. The device of claim 26 wherein the metal chlorite is sodium chlorite.

43. The device of claim 42 wherein the acid forming component is a dry water soluble solid which produces an acidic solution when dissolved in water.

44. The device of claim 43 wherein the acid forming component is selected from the group consisting of acids and acidic salts.

45. The device of claim 44 wherein the acid is selected from organic acids.

46. The device of claim 45 wherein the organic acids are selected from the group consisting of citric acid, tartaric acid, and oxalic acid.

47. The device of claim 46 wherein the organic acid is citric acid.

48. The device of claim 44 wherein the acidic salts are selected from the group consisting of alkali metal acid salts and alkaline earth metal acidic salts.

49. The device of claim 44 wherein the acidic salts are selected from the group consisting of magnesium nitrate, lithium chloride, magnesium sulfate, aluminum sulfate, sodium acid sulfate and potassium acid sulfate.

50. The device of claim 26 wherein the synthetic molecular sieves are selected from the group consisting of synthetic zeolite Y, dealuminated Y, mordenite and ZSM-5.

51. The device of claim 26 wherein the acid forming component produces a pH of below about 5 when mixed with water.

52. The device of claim 26 wherein the aqueous solution of chlorine dioxide has a pH of between from about 2 to about 10.

53. The device of claim 26 wherein the membrane is water softenable.

54. The device of claim 26 wherein the membrane is at least partially water soluble.

55. The device of claim 54 wherein the membrane dissolves in water after a period of time at least equal in length to the time it takes the metal chlorite and the acid forming component to substantially react to produce chlorine dioxide.

56. The device of claim 26 wherein the membrane is made of a material selected from the group consisting of gelatin, polyvinyl alcohol, cellulose and derivatives thereof.

57. The device of claim 56 wherein the derivative of cellulose is hydroxypropyl methyl cellulose.

58. The device of claim 28 wherein the membrane material is made from a microporous nonwoven hydrophobic polymer.

59. The device of claim 58 wherein the microporous nonwoven hydrophobic polymer is selected from polyethylene and polytetrafluoroethylene.

60. The device of claim 26 wherein the membrane contains openings of sufficient size to enable the controlled passage of water into contact with the metal chlorite and the acid forming component.

61. The device of claim 26 wherein the mixture is present in the second zone in the form of tablets.

62. The device of claim 26 wherein the mixture is present in the second zone in the form of powders.

63. The device of claim 26 wherein the mixture is present in the second zone in the form of granules.



64. The device of claim 26 wherein the mixture is present in the second zone in the form of pellets.

65. The device of claim 26 wherein the mixture is present in the second zone in the form of agglomerates.

66. The device of claim 65 wherein the agglomerates in the second zone are present as two types:

- (c) a first type comprising at least one metal chlorite or a mixture of one or more metal chlorites and one or more non-acid forming additives; and
- (d) a second type comprising at least one acid forming component or a mixture of one or more acid forming components and one or more metal chlorite-free additives.

67. The device of claim 66 wherein the non-acid forming additives are selected from the group consisting of silica gel desiccant, paraffin wax tableting binder, sodium sulfate filler and mixtures thereof.

68. The device of claim 66 wherein the metal chlorite-free additives are selected from the group consisting of ion exchangers, tableting binders, desiccants and mixtures thereof.

69. The device of claim 65 wherein the agglomerates have a particle size of at least 80 microns.

70. The device of claim 69 wherein the agglomerates have a particle size above about 500 microns.

71. The device of claim 70 wherein the agglomerates have a particle size above about 1,000 microns.